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(71) Applicant  
Meir Mordechai  
11 Foxtail Road, Ransomes Industrial Estate, Ipswich,  
Suffolk, IP3 9RT, United Kingdom

(72) Inventor  
Meir Mordechai

(74) Agent and/or Address for Service  
Dummett Copp & Co  
25 The Square, Martlesham Heath, Ipswich, IP5 7SL,  
United Kingdom

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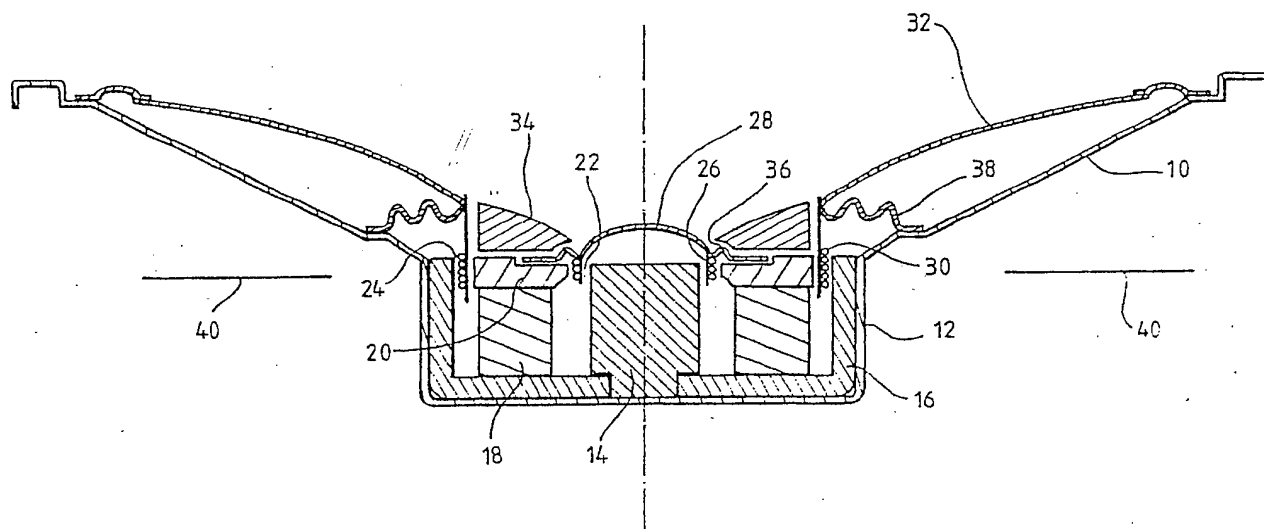
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(56) Documents cited  
GB 0841666 A GB 0767309 A GB 0696852 A  
GB 0665815 A GB 0641651 A GB 0469194 A  
GB 0455208 A GB 0445935 A GB 0442900 A  
GB 0308317 A

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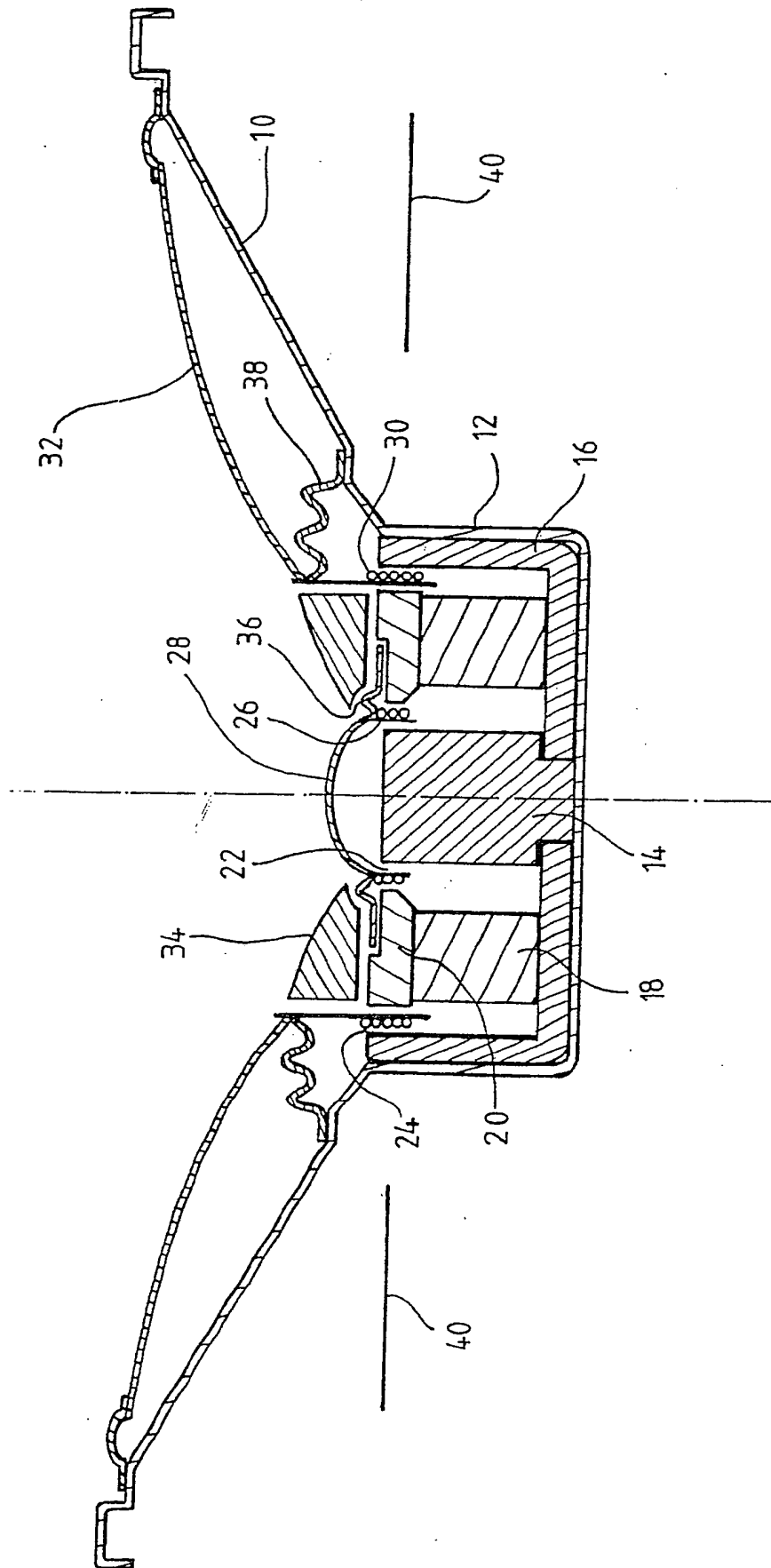
(54) A loudspeaker

(57) A loudspeaker has treble and bass diaphragms 32, 28 combined in a single unit. The two diaphragms are driven by separate voice coils 30, 26 and the coils both move relative to a single magnet 18. Both coils lie in a common plane 40 perpendicular to the longitudinal axis of the loudspeaker.



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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A LOUDSPEAKER

This invention relates to a loudspeaker, particularly a loudspeaker for reproducing sounds over a wide frequency range such as is required, for example, in reproducing music.

It is well known to divide the audio frequency range and to provide separate speaker components for dealing with different parts of the frequency range. In a conventional terminology "woofer" is a speaker which deals with the low frequency (or bass sound) and a "tweeter" deals with the high frequency (or treble) sounds.

In some installations, a separate woofer and separate tweeter are mounted together in a single enclosure to cover the full frequency range. In other known installations, the woofer and the tweeter are combined together in a single loudspeaker unit. Each loudspeaker unit has a diaphragm connected to a voice coil. The voice coil is positioned in an air gap traversed by lines of magnetic flux and as a varying signal is passed to the voice coil, so the voice coil is caused to move in the magnetic field resulting in vibration of the diaphragm and the production of audible sound.

In the known combination loudspeakers, it has been found necessary to have one magnet system for the tweeter and a second magnet system for the woofer. Since the tweeter diaphragm and the woofer diaphragm are arranged coaxially, it is then necessary for one magnet system to be behind the other, as viewed along the axis of the loudspeaker. This is disadvantageous in that the diaphragms for the two speakers are also spaced from one another along the axis. As a result the air vibrations produced by diaphragm movement of

the treble and bass diaphragms will be out of phase with one another, and this leads to a drop in the sound quality.

According to the present invention, there is provided a  
5 loudspeaker having a bass voice coil, a bass diaphragm  
driven by the bass voice coil, a treble voice coil and a  
treble diaphragm driven by the treble voice coil, wherein  
both the bass and the treble voice coils are mounted for  
movement relative to a common plane at right angles to the  
10 axis of the loudspeaker.

With this arrangement, the treble and bass voice coils can  
lie at the same point along the loudspeaker axis, so that it  
becomes possible to achieve a true single point acoustic  
15 source for the reproduction of full range, linear phase and  
time-coherent sound quality.

The ring magnet preferably surrounds a first magnet pole  
piece and is surrounded by a second magnet pole piece, so  
20 that two magnetic gaps are formed, one being of smaller  
diameter than the ring magnet and the other being of larger  
diameter.

Preferably the treble voice coil is arranged in the smaller  
25 diameter magnetic gap, and the bass voice coil in the larger  
diameter gap. The treble diaphragm can be in the form of a  
dome at the centre of the loudspeaker, and the bass  
diaphragm can be in the form of a cone.

30 According to a second aspect of the invention, there is  
provided a loudspeaker having a bass voice coil a bass  
diaphragm driven by the bass voice coil, a treble voice  
coil, a treble diaphragm driven by the treble voice coil and  
a common ring magnet relative to which both the bass and  
35 treble voice coils can move.

The invention will now be further described, by way of example, with reference to the accompanying drawing which shows a cross section through a loudspeaker in accordance with the invention.

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The loudspeaker shown in the drawing has a chassis 10. In a cup formation at the base 12 of the chassis is a soft iron pole piece 14 and a soft iron cup 16. An annular or ring magnet 18 is fitted between the pole 14 and the cup 16, and supports an annular metal plate 20. The plate 20 defines an inner magnetic gap 22 with the pole piece 14 and an outer magnetic gap 24 with the cup 16.

15 In the inner gap 22, a treble voice coil 26 is positioned. This coil drives a treble diaphragm 28 in the form of a dome. In the outer gap 24, a bass voice coil 30 is positioned, and this coil drives a bass diaphragm 32 in the form of a cone. A face plate 34 is fitted between the treble and bass diaphragms. The diaphragms 28 and 32 are supported by conventional diaphragm suspension arrangements indicated at 36 and 38 respectively.

25 The signal feeds to the voice coils 26 and 30 will be provided in a conventional manner. However since both voice coils oscillate about a common plane which is indicated in the drawing by the line 40, the air vibrations set up by the two diaphragms both emanate from the same plane and from the same point in that plane. Sound produced by both diaphragms will therefore be in phase and time-coherent.

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It is an additional advantage of this invention that the loudspeaker described here uses less separate components and is therefore cheaper to manufacture and easier to assemble than conventional combined treble/bass loudspeakers.

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CLAIMS

1. A loudspeaker having a bass voice coil, a bass diaphragm driven by the bass voice coil, a treble voice coil and a treble diaphragm driven by the treble voice coil, wherein both the bass and the treble voice coils are mounted for movement relative to a common plane at right angles to the axis of the loudspeaker.
2. A loudspeaker as claimed in Claim 21, wherein the ring magnet surrounds a first magnet pole piece and is surrounded by a second magnet pole piece, so that two magnetic gaps are formed, one being of smaller diameter than the ring magnet and the other being of larger diameter.
3. A loudspeaker as claimed in Claim 1 or Claim 2, wherein the treble and bass voice coils both vibrate relative to a common plane which is perpendicular to the axis of the ring magnet.
4. A loudspeaker as claimed in any preceding claim, wherein the treble and bass diaphragms are coaxial.
5. A loudspeaker as claimed in Claim 4, wherein the treble diaphragm is located within the bass diaphragm.
6. A loudspeaker having a bass voice coil, a bass diaphragm driven by the bass voice coil, a treble voice coil, a treble diaphragm driven by the treble voice coil, and a common ring magnet relative to which both the bass and treble voice coils can move.
7. A loudspeaker substantially as herein described with reference to and as shown in the accompanying drawing.

**Patents Act 1977**  
**Examiner's report to the Comptroller under**  
**Section 17 (The Search Report)**

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**Relevant Technical fields**

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(ii) Int CI (Edition 5 ) H041 1/24, 1/26, 9/00, 9/02,  
9/04, 9/06, 11/00, 11/02

**Databases (see over)**

(i) UK Patent Office

(ii)  
ONLINE DATABASES: WPI, CLAIMS

Search Examiner

P J EASTERFIELD

Date of Search

27 FEBRUARY 1992

Documents considered relevant following a search in respect of claims

1 TO 6

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	GB 0841666 A (SWIFT LEVICK) whole document	1 to 6
X	GB 0767309 A (GOODMANS) whole document	1 to 6
X	GB 0696852 A (GOODMANS) whole document	1 to 6
X	GB 0665815 A (MARCONI) whole document	1 to 6
X	GB 0641651 A (CHAPMAN) whole document	1,3 to 6
X	GB 0469194 A (WEEKS) whole document	1,3 to 6
X	GB 0455208 A (SHARP AND MCGRATH) see Figure 1	1,3 to 6
X	GB 0445935 A (EVANS) see Figures 1,2,3	1 to 6
X	GB 0442900 A (ENGLISH STEEL) whole document	1 to 6
X	GB 0308317 A (MARCONI) whole document	1 to 6

Category	Identity of document and relevant passages	Relevant to claim(s)

### Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family, corresponding document.

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